Madden/Julian Oscillation: Recent Evolution, Current Status and Forecasts

Update prepared by
Climate Prediction Center / NCEP
February 6, 2006

Outline

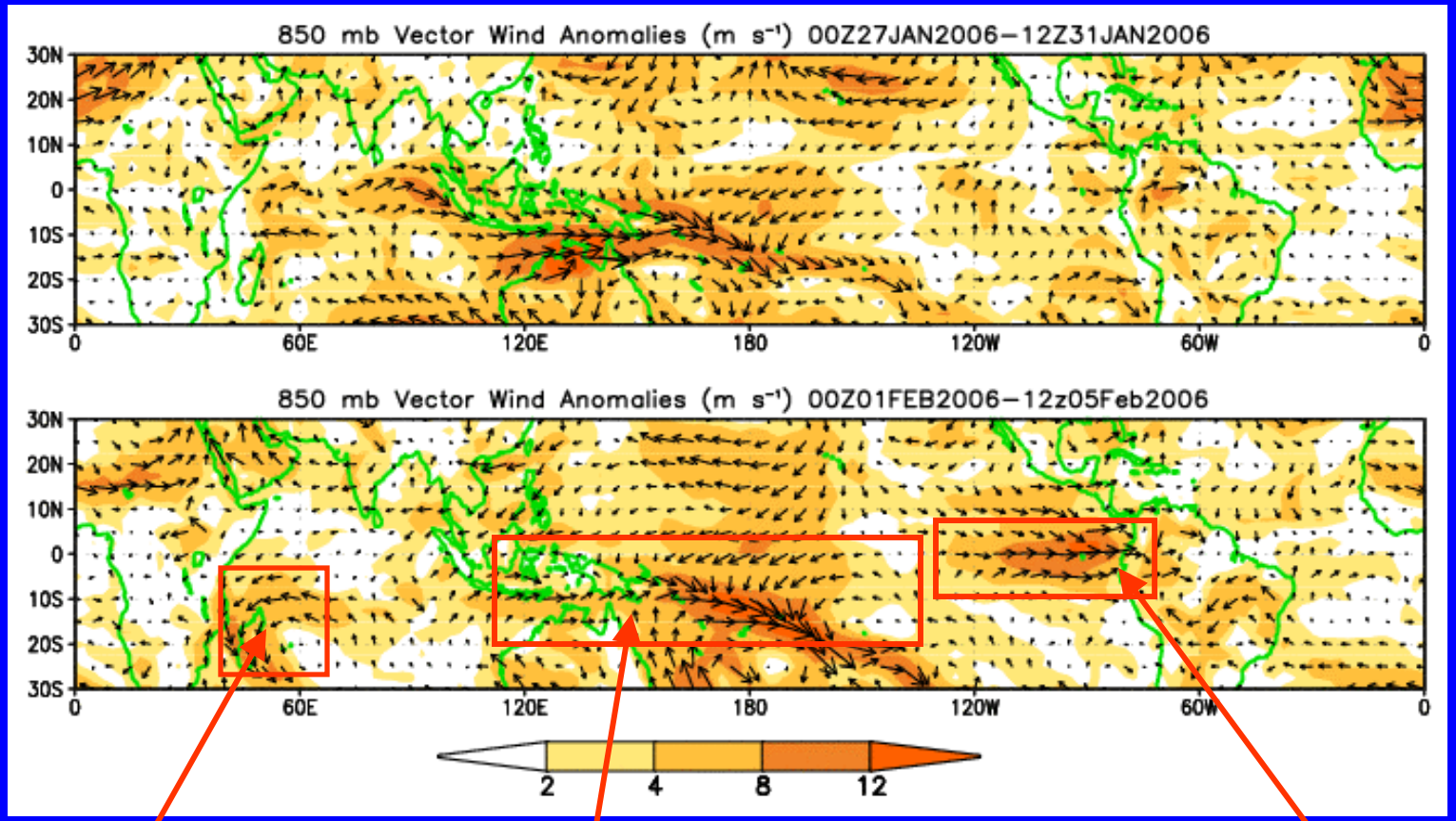
- Overview
- Recent Evolution and Current Conditions
- Madden Julian Oscillation Forecast
- Summary

Overview

- A weak MJO signal has developed with its enhanced (suppressed) phases mainly located in the western Hemisphere (Indian Ocean) respectively and is modulating the current La Nina pattern.
- Also, a slow moving couplet of suppressed (enhanced) convection, closer to the seasonal time scale, has shifted east during the past week resulting in strong suppressed convection across the Indian Ocean and western Indonesia and enhanced convection across eastern Indonesia and the western Pacific ocean especially in the vicinity of the South Pacific Convergence Zone (SPCZ).
- Enhanced (suppressed) convection was also observed across portions of southern Africa (central equatorial Pacific, the eastern Brazil, northeast south Africa). During the past week, strong westerly low-level wind anomalies extended across Indonesia and northern Australia mainly in the southern Hemisphere increasing convergence along the SPCZ.
- The MJO is expected to remain weak during the upcoming 1-2 week period with tropical convection expected to return to that more similar of La Nina conditions.
- For week 1, there is an increased chance for above normal rainfall over Indonesia, northern Australia and the southwestern Pacific. There is also the potential for tropical cyclogenesis over the southwestern Pacific during the period. There is an increased chance for above average rainfall over northern South America, western and southern Brazil, Bolivia, and southern Africa. Below normal rainfall is expected over the central equatorial Pacific.
- During week 2, there is an increased chance for below normal rainfall over the central equatorial Pacific. There is an increased chance for above normal rainfall over the eastern Indian Ocean, Indonesia, northern Australia and the southwestern Pacific. The potential for tropical cyclogenesis exists north of Australia and the southwestern Pacific Ocean.
- Although not highlighted on hazard maps, there is a threat of above average rainfall near and to the east of Hawaii in the northeastern Pacific Ocean during week 2 as upper-level low pressure may develop in this vicinity.

850-hPa Vector Wind Anomalies (m s^{-1})

Note that shading denotes the magnitude of the anomalous wind vectors

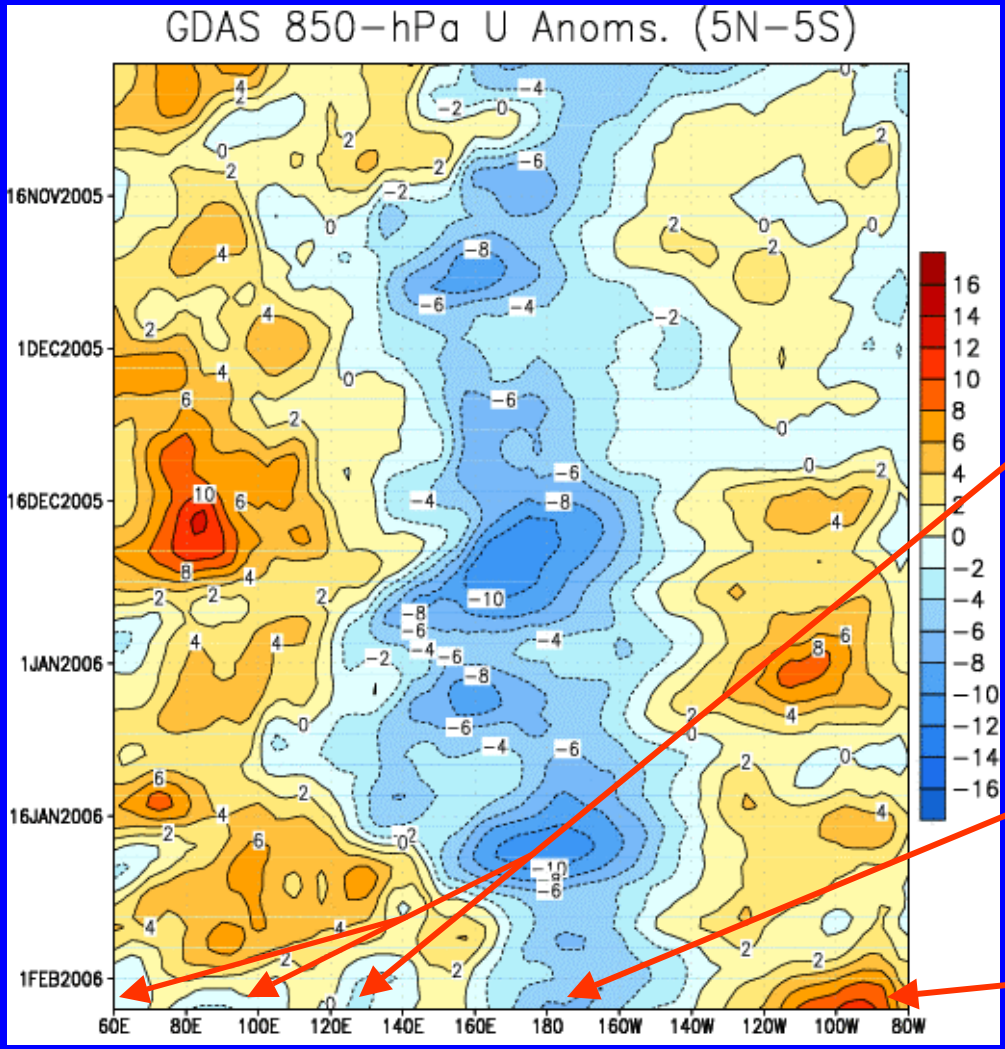


Amplified Mascarene high pressure system over the central Indian Ocean into Madagascar and the Mozambique Channel

Westerly anomalies over eastern Indonesia and New Guinea weakened but continued to extend further east-southeast across Polynesia into the subtropics. Flow associated with an enhanced SPCZ.

Westerly anomalies strengthened significantly in the eastern Pacific Ocean

Low-level (850-hPa) Zonal (east-west) Wind Anomalies (m s^{-1})



Time

Longitude

Weaker-than-average easterlies or westerlies (orange/red shading).

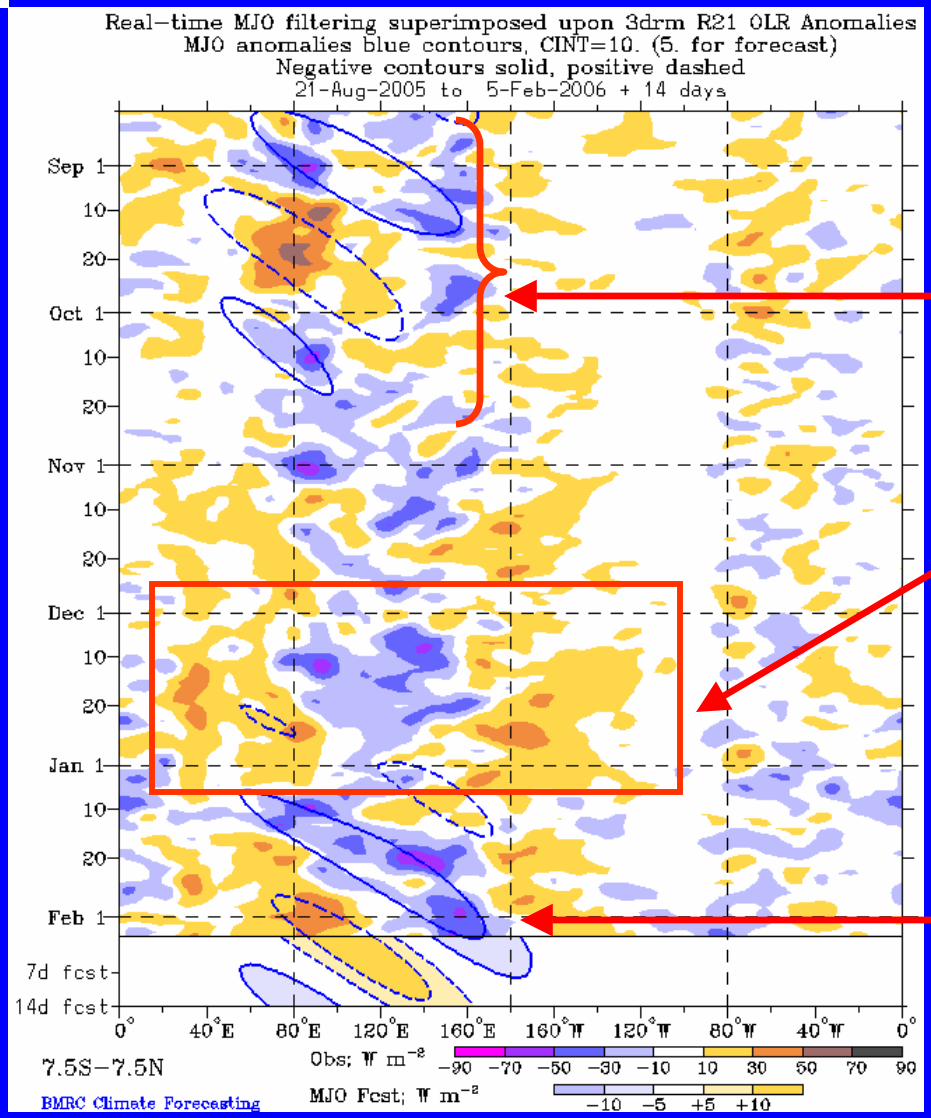
Stronger-than-average easterlies (blue shading).

Westerly anomalies have decreased and easterly anomalies have formed across Indonesia. Also a pockets of easterly anomalies have formed over the Indian Ocean.

Lower tropospheric easterly anomalies have slightly increased at the date line.

Westerly anomalies increased in the eastern Pacific Ocean.

Outgoing Longwave Radiation (OLR) Anomalies (7.5°S-7.5°N)



Time

Longitude

Drier-than-average conditions (/red shading)

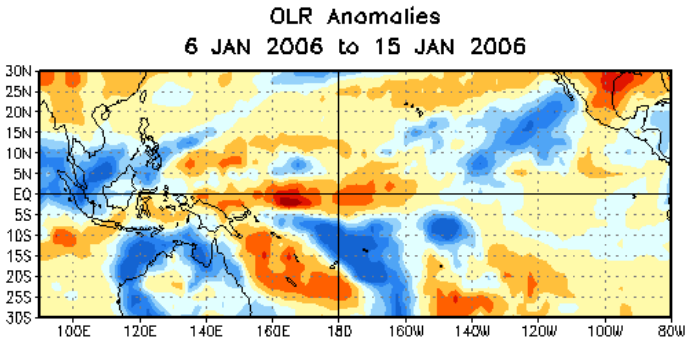
Wetter-than-average conditions (blue shading)

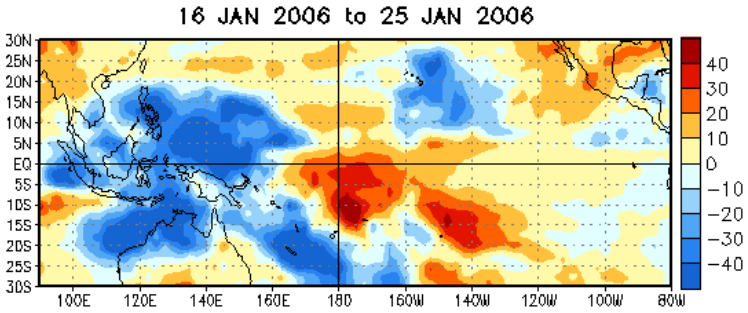
Weak MJO activity was evident during September and October as OLR anomalies propagated eastward from the Indian Ocean to the western Pacific Ocean

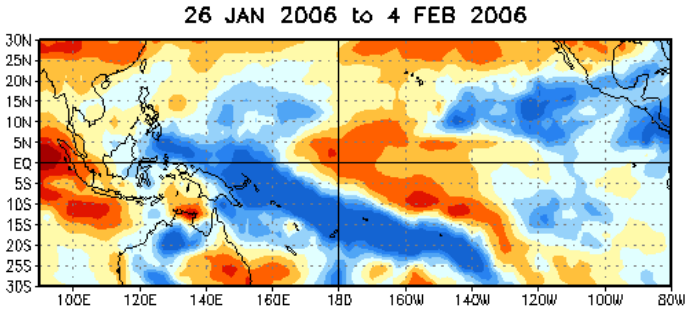
Enhanced convection was quasi-stationary across sections of the eastern Indian Ocean, Indonesia and the western Pacific Ocean during late November and December

A couplet of suppressed and enhanced convection stretching from Indonesia into the western Pacific Ocean has shifted to the east during the past week.

Anomalous OLR and 850-hPa Wind: Last 30 days

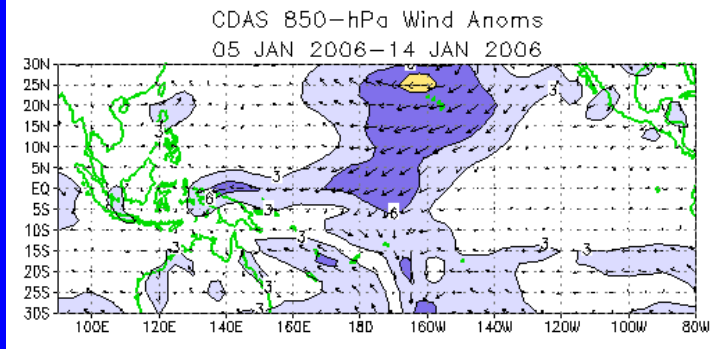


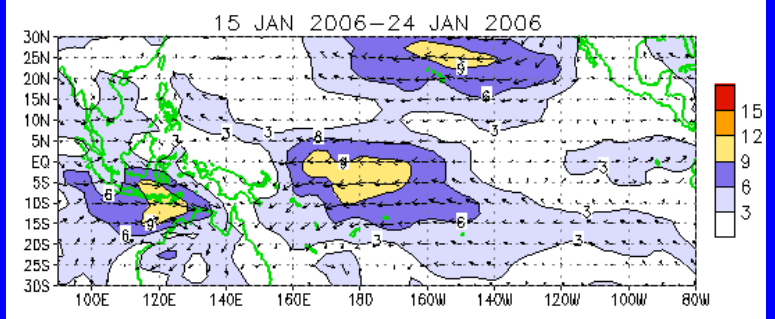


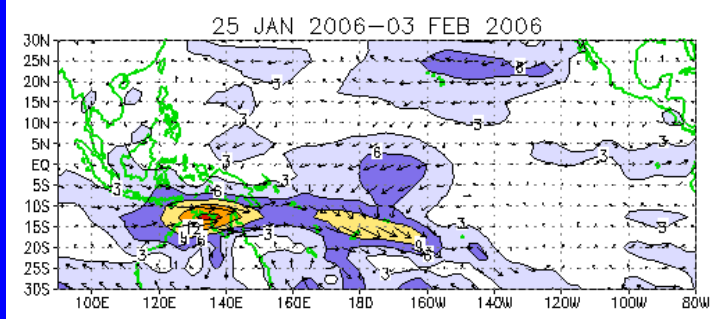


During the past 30 days, a pattern of enhanced (suppressed) convection has been evident across Indonesia (the central Pacific Ocean). The pattern has amplified over the past week and has extended southeastwards across Polynesia.

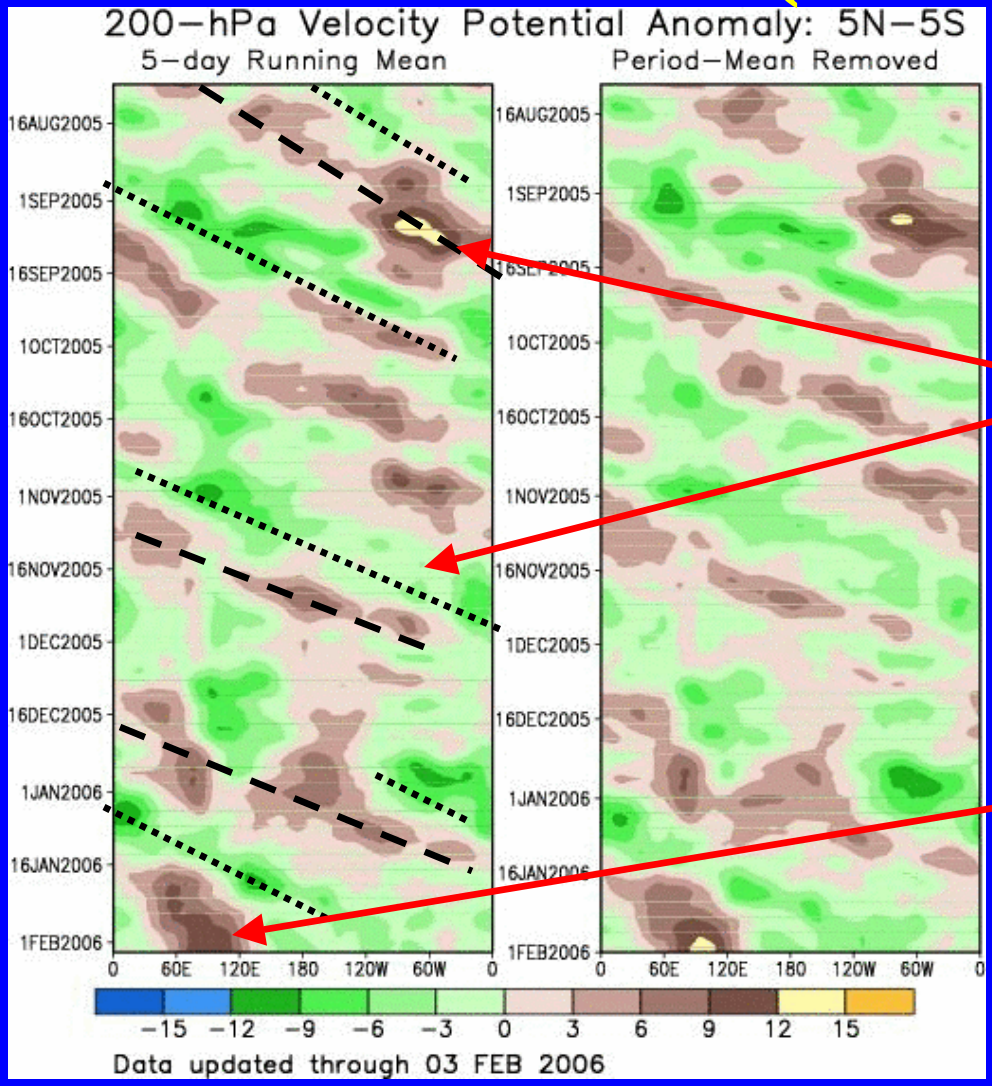
Easterly anomalies have weakened in the western Pacific Ocean. Strong westerly anomalies persisted across the eastern Indian Ocean and Java over the past 2 weeks.







200-hPa Velocity Potential Anomalies (5°S-5°N)



Time

Longitude

Positive anomalies (brown shading) indicate unfavorable conditions for precipitation.

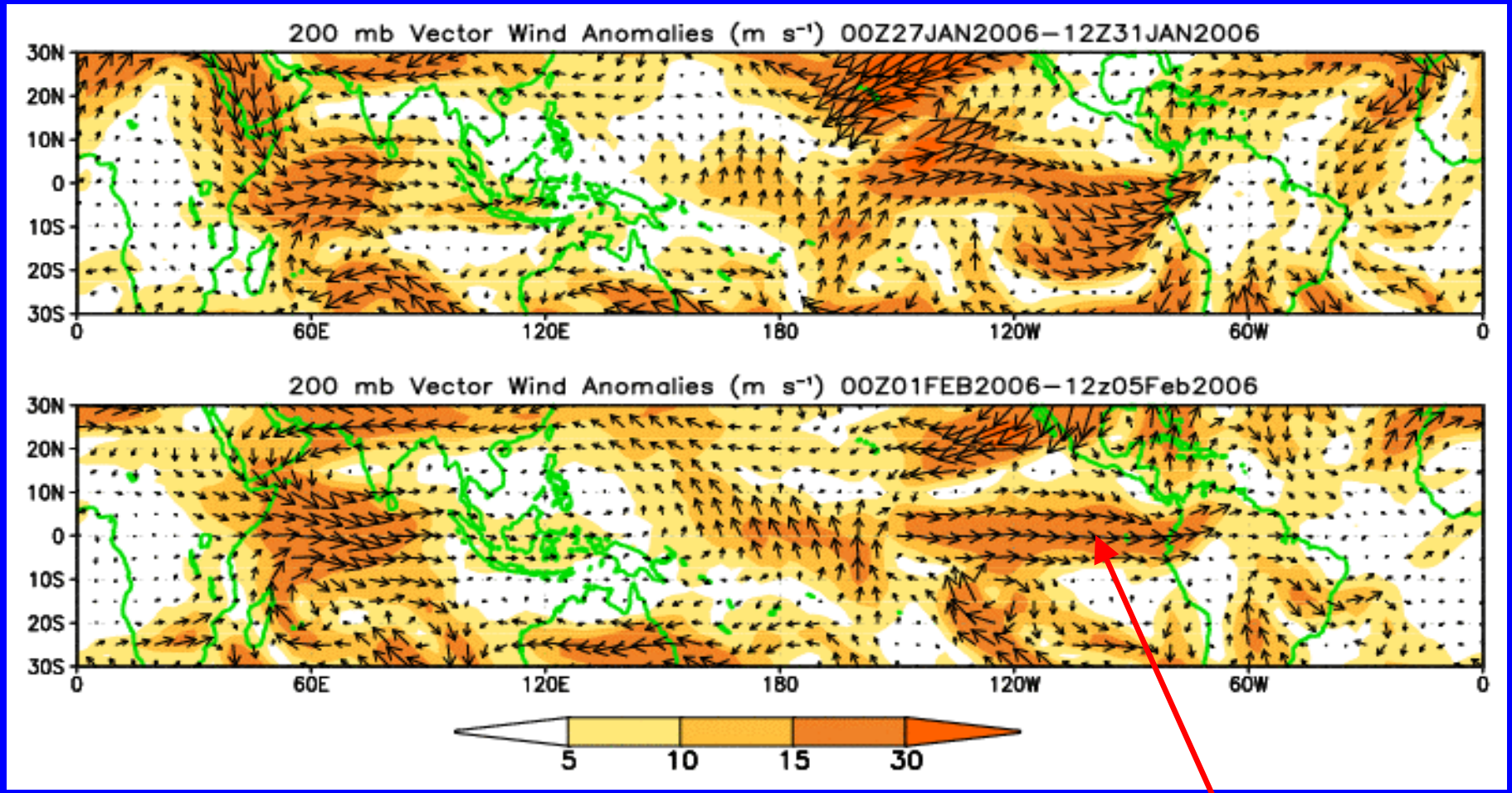
Negative anomalies (green shading) indicate favorable conditions for precipitation.

Weak to moderate MJO activity was observed at times during the period from August into November.

During the past week, strong upper-level convergence was evident across the Indian Ocean and western Indonesia. This area has slowly propagated east during the past week.

200-hPa Vector Winds and Anomalies (m s^{-1})

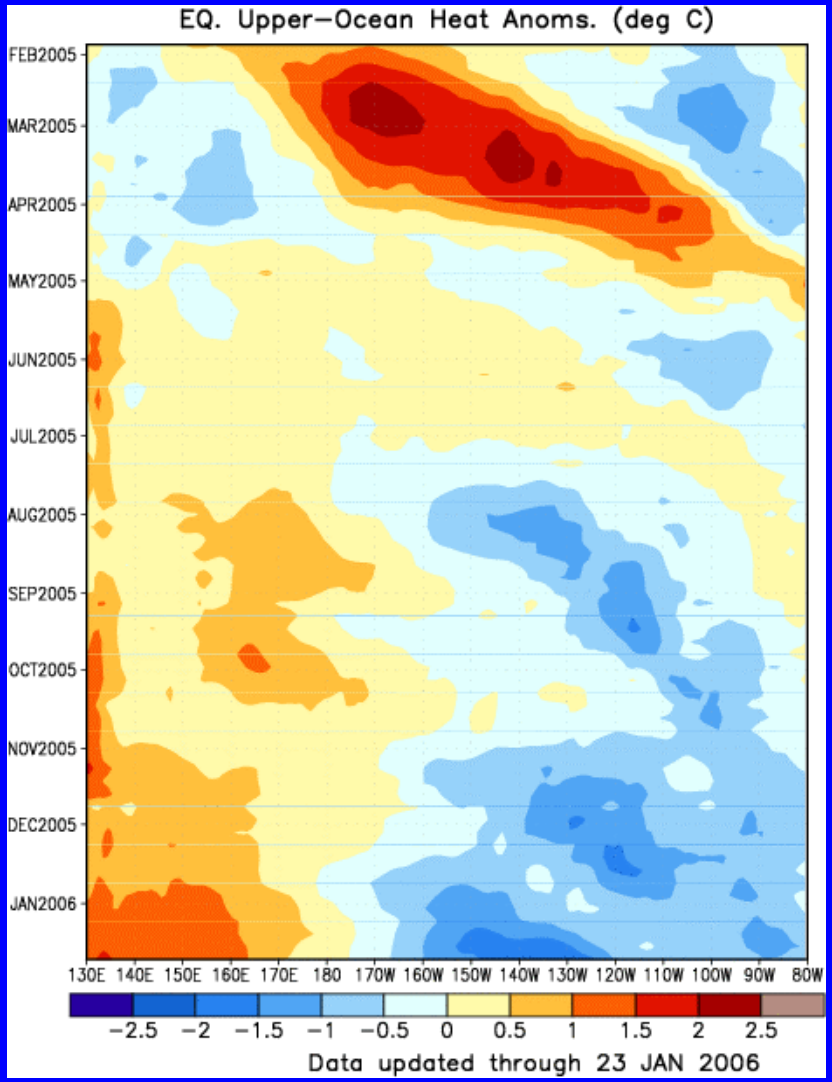
Note that shading denotes the magnitude of the anomalous wind vectors.



Upper tropospheric westerlies are stronger than normal along the equator from the east-central Pacific to South America

Heat Content Evolution in the Eq. Pacific

Time



Longitude

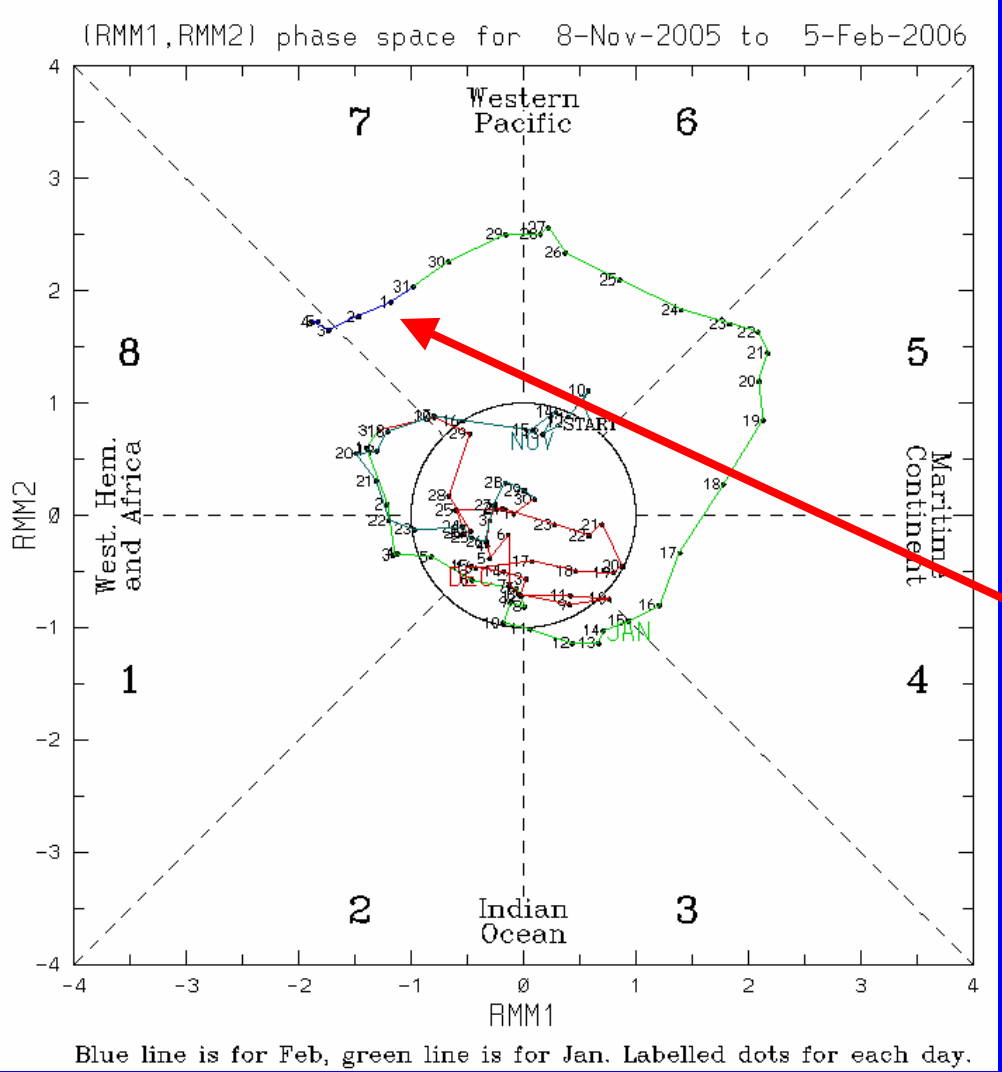
During February 2005, a strong Kelvin wave developed and continued to strengthen during March and reached the South American coast during early April. The Kelvin wave was initiated when the easterlies weakened over the equatorial Pacific in association with MJO activity.

Heat content has been above average in the western Pacific since June and has slightly increased. Cooler water observed across the eastern Pacific with a westward extension evident since November has also amplified.

MJO Index (Magnitude and Phase)

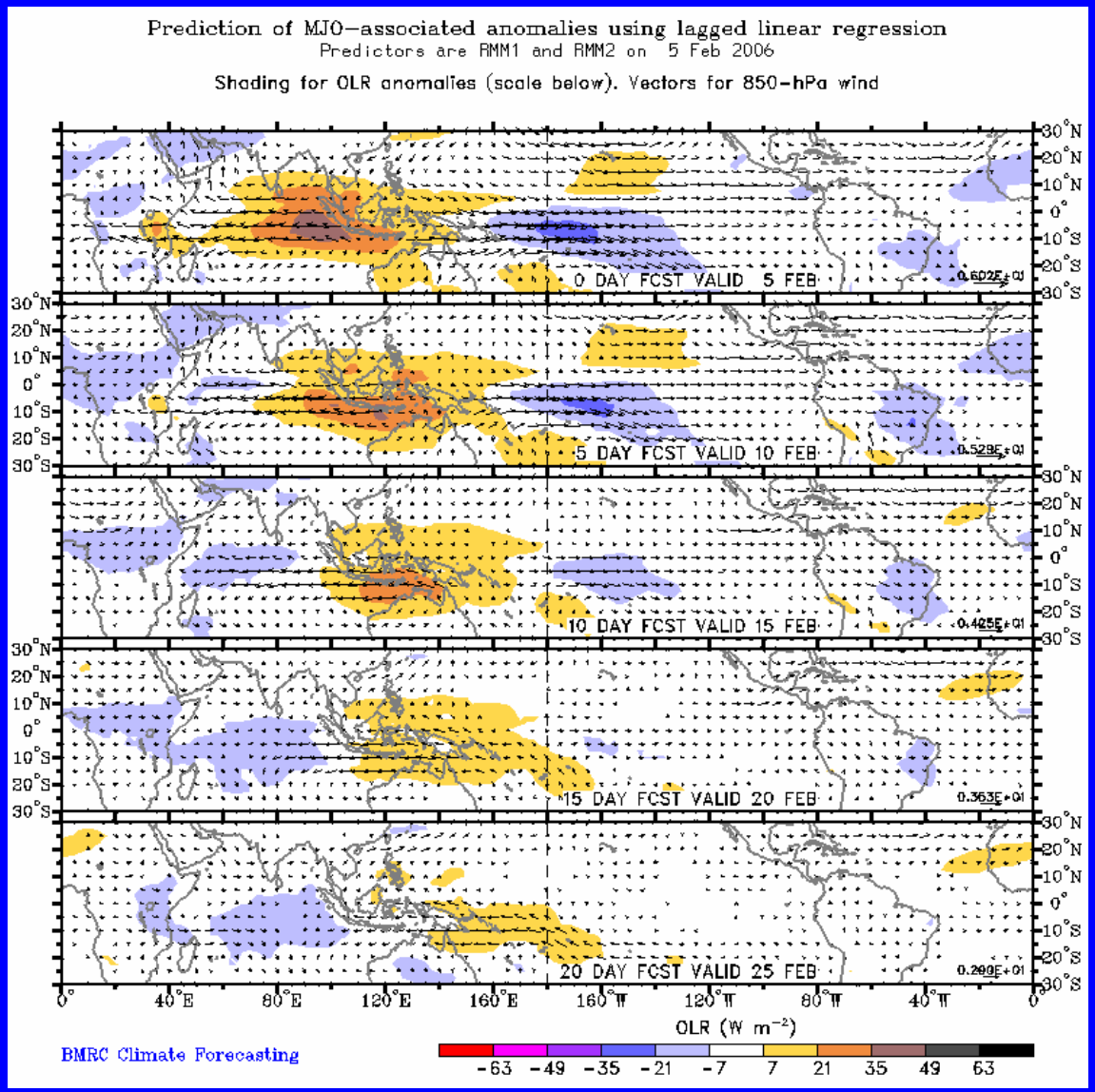
The current state of the MJO as determined by an index based on Empirical Orthogonal Function (EOF) analysis using combined fields of near-equatorially-averaged 850 hPa zonal wind, 200 hPa zonal wind, and satellite-observed outgoing longwave radiation (OLR) (Wheeler and Hendon, 2004).

The axes represent the time series of the two leading modes of variability and are used to measure the amplitude while the triangular areas indicate the phase or location of the enhanced phase of the MJO. The farther away from the center of the circle the stronger the MJO. Different color lines indicate different months.



The global OLR, low level wind, and upper level wind data continued to suggest a coherent, slow moving MJO type pattern. This pattern is superimposed upon the quasi-stationary La Nina pattern.

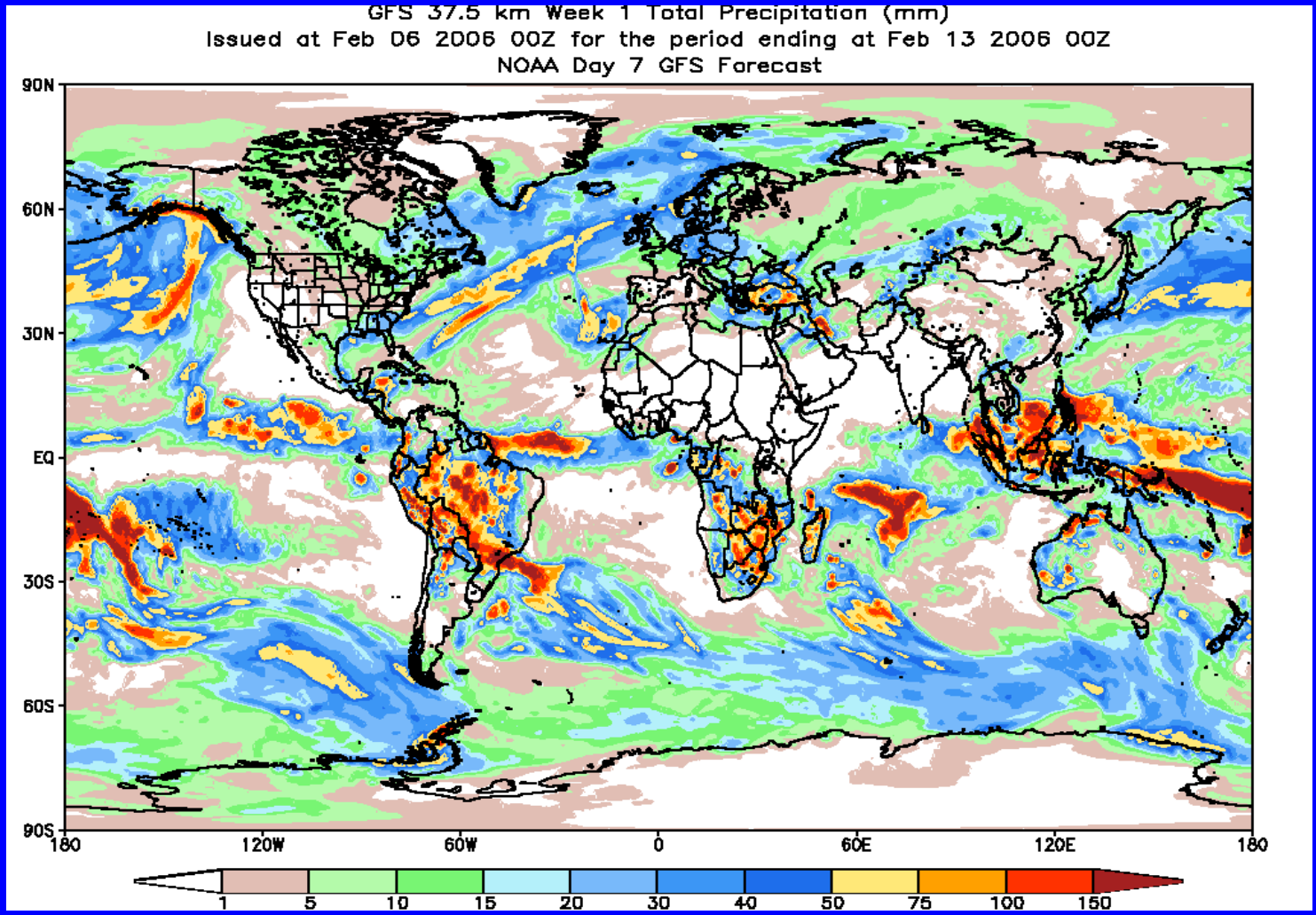
Statistical OLR MJO Forecast



A statistical MJO forecast indicates enhanced convection over the western Pacific Ocean into the southern hemisphere subtropics during week 1, with suppression over the eastern Indian Ocean, across Indonesia, and northern Australia.

For week 2, the statistical MJO forecast indicates enhanced convection over the western Pacific east of the date line and suppression over the Maritime Continent.

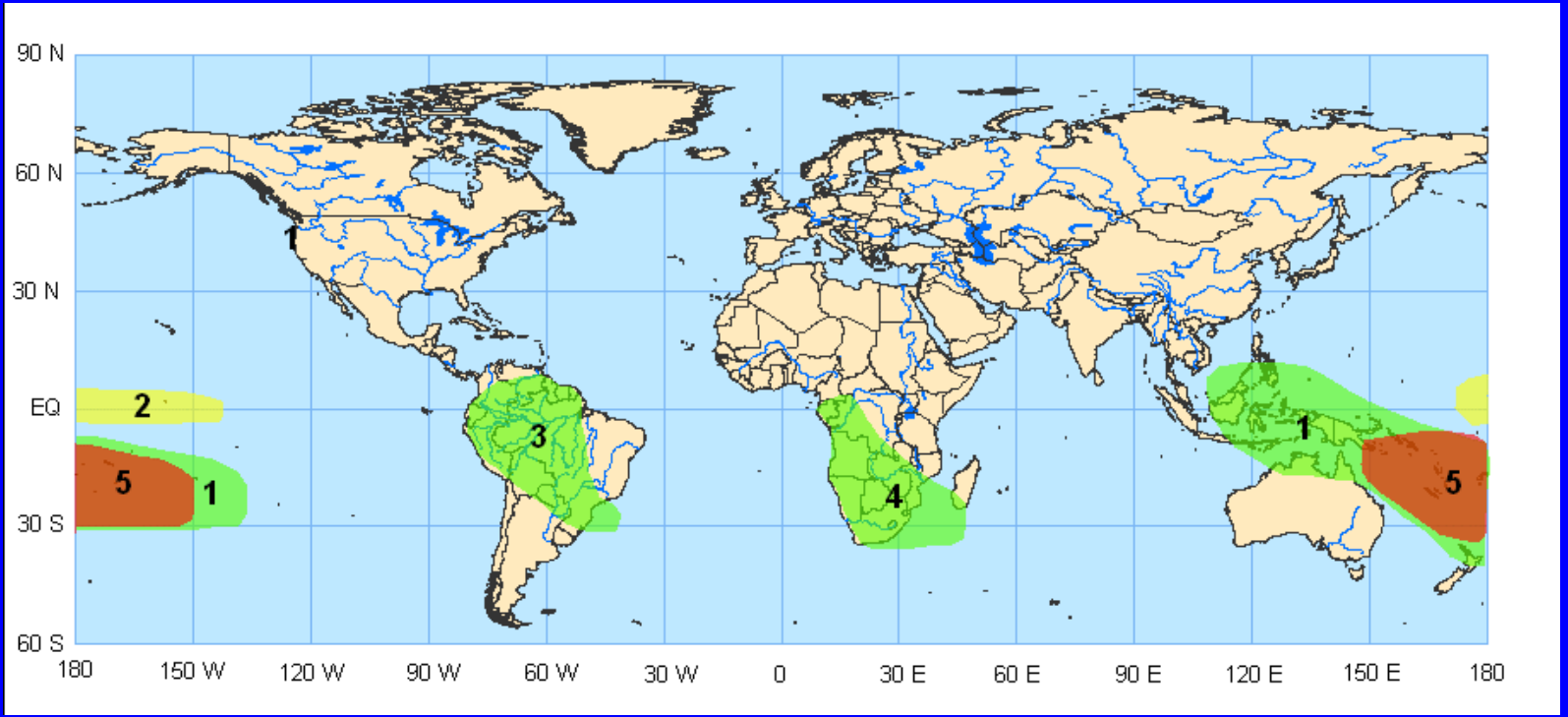
Global Forecast System Precipitation Forecast



The GFS is indicating enhanced rainfall over Indonesia, southwestern Pacific, western Brazil, northern Southern Africa, and central Indian Ocean.

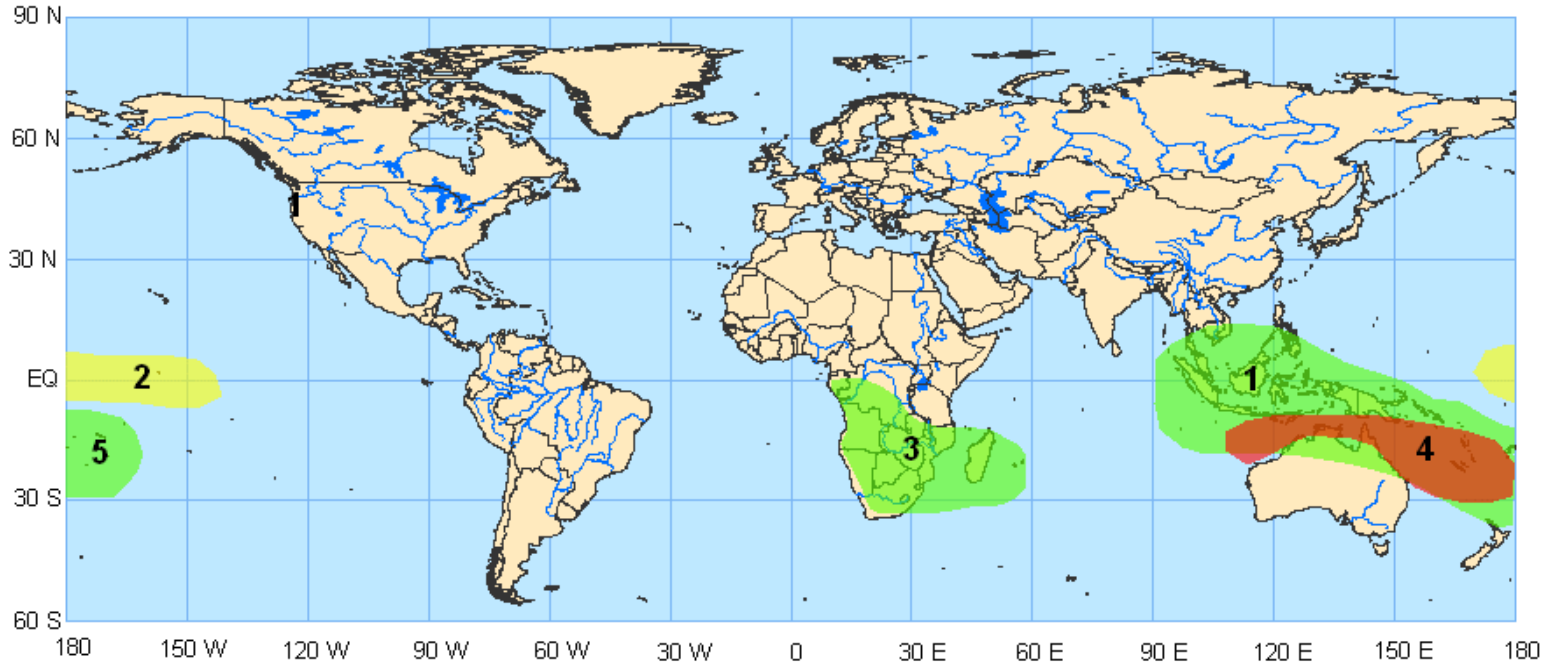
The GFS is showing seasonal rains over northern Africa, and northern and southern South America.

Potential Benefits/Hazards – Week 1
Valid February 7 – February 13, 2006



1. An increased chance for above normal rainfall over the Maritime Continent, northern Australia and the southwestern Pacific Ocean due to enhancement of convection associated with the continuation of La Nina conditions
2. An increased chance for below normal precipitation across the central equatorial Pacific due to cool sea surface temperatures
3. An increased chance for above normal rainfall over northern South America, the western two thirds of Brazil and Bolivia due to enhancement of convection associated with a weak MJO signal and interaction with extratropical frontal systems
4. An increased chance for above normal rainfall over southern and west central Africa due to a weak MJO signal and a continuation of La Nina conditions
5. Tropical cyclogenesis is possible across the southwest Pacific Ocean due to favorable atmospheric conditions (enhanced convection, low level westerly anomalies)

Potential Benefits/Hazards – Week 2
Valid February 14-20, 2006



1. An increased chance for above normal rainfall over the Maritime Continent, northern Australia and the southwestern Pacific due to enhancement of convection associated with the continuation of La Nina conditions
2. An increased chance for below normal precipitation across the central equatorial Pacific due to cool sea surface temperatures
3. An increased chance for above normal rainfall over west-central and southern Africa due to a weak MJO signal and a continuation of La Nina conditions
4. Tropical cyclogenesis is possible north of Australia and in the southwest Pacific Ocean due to favorable atmospheric conditions (enhanced convection, low level westerly anomalies)

Summary

- A weak MJO signal has developed with its enhanced (suppressed) phases mainly located in the western Hemisphere (Indian Ocean) respectively and is modulating the current La Nina pattern.
- Also, a slow moving couplet of suppressed (enhanced) convection, closer to the seasonal time scale, has shifted east during the past week resulting in strong suppressed convection across the Indian Ocean and western Indonesia and enhanced convection across eastern Indonesia and the western Pacific ocean especially in the vicinity of the South Pacific Convergence Zone (SPCZ).
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- Although not highlighted on hazard maps, there is a threat of above average rainfall near and to the east of Hawaii in the northeastern Pacific Ocean during week 2 as upper-level low pressure may develop in this vicinity.